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EFFECT OF GROWTH REGULATORS ON PLANT EMERGENCE, GROWTH AND FLOWER PRODUCTION OF GLADIOLUS

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Abstract

Effects of growth regulators on plant emergence, growth and flower production of gladiolus were studied at Bangladesh Agricultural University, Mymensingh during November 2007 to April 2008 under a replicated field trial. Three doses of gibberellic acid (GA_3) viz. 50 ppm, 100 ppm, 200 ppm and Paclobutrazol (PP333) viz. 20 ppm, 40 ppm and 80 ppm including control treatments were tested. It was found that GA_3 showed better performance than the PP333, GA_3 at 200 ppm showed the best result in yield contributing characters such as reducing the number of days for 80% emergence, first spike initiation, 80% spike initiation, 80% harvest and increasing the number of tiller per hill, total number of spike per hill, length of spike and rachis, number of florets per spike and shelf-life of flower production of gladiolus.

Introduction

Gladiolus (*Gladiolus grandiflorus* L.), is a popular cut flower usually known as Sword Lily. It is a monocot ornamental bulbous plant native of South Africa (Sharma and Sharma, 1984) under Iridaceae family. It is estimated that more than 2,500 hectare of land is under gladiolus cultivation in Bangladesh (Dadlani, 2003).

Plant growth and development are regulated by naturally produced chemicals or endogenous plant hormones. The potential use of growth regulators in flower production has created considerable scientific gain in recent years. Auge (1982) observed early growth and flowering in gladiolus cv. Sylvia when corms were kept in GA_3 solutions for 24 hours. Corms treated with GA_3 enhanced plant growth and flowering in gladiolus in India (Bhattacharjee, 1984). Dua *et al.* (1984) observed improved flower quality and better corm multiplication when corms of gladiolus were soaked in 100 ppm GA_3 before planting. EL-Meligy (1982) observed higher anthocyanin accumulation in flowers resulting deeper flower colour when treated with GA_3 500 ppm. Nilimesh and Roychowdhury (1989) treated gladiolus corms (2.5- 2.7 cm in diameter) by soaking for 6 hours in GA_3 (50 or 100 ppm) irrespective of concentration increased plant height, flower stalk length and yield of corms per unit area and decreased the days required to 50% inflorescence initiation and percentage of lodging plant. In a separate investigation, Mahesh and Misra (1993) studied the effect of gibberellic acid (200, 500 and 1000 ppm) on gladiolus cv. Snow Princess where significant changes in growth and flowering

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were obtained for many parameters. GA_3 at 200 ppm increased the plant height from 87.39 to 91.94 cm but the GA_3 at 1000 ppm increased the number of florets/spike from 10.19 to 10.67. Use of GA_3 at 0, 50, 100, 200, or 400 ppm on gladiolus corm *cv.* Sylvia at Kanpur, India enhanced vegetative growth, flowering and number of corm and cormel production, but adversely affected individual corm weight while higher doses (200 and 400 ppm) reduced the duration of flowering (Misra *et al.* 1993). Karaguzel *et al.* (1999) reported that GA_3 at 100 ppm shortened the time from planting to harvest, and increased flowering percentage, the length of flowering stems and spikes, the number of flowers per spike and diameter of flower stems. Sharma *et al.* (2006) also reported that application of GA_3 at 200ppm enhanced sprouting and resulted in maximum plant height, maximum number of leaf per plant, longer leaf length, longer spike length, more number of florets per spike, longer rachis length, floret length, number of corms per plant and with vase life longer.

Use of Paclobutazol (PP333) in gladiolus as growth regulator has not yet been reported by any researchers. The present investigation was undertaken to study the growth, flowering and yield performance of gladiolus by utilizing different doses of growth regulators and to find out the optimum level of GA_3 or Paclobutrazol for vegetative growth and quality production of gladiolus flowers.

Materials and Methods

The study was conducted at the field laboratory of USDA Allium project, Horticulture Farm, Bangladesh Agricultural University, Mymensingh during November, 2007 to April, 2008. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatments were: i) GA_3 50 ppm; ii) GA_3 100 ppm; iii) GA_3 200 ppm; iv) PP333 20 ppm; v) PP333 40 ppm; vi) PP333 80 ppm; vii) and untreated control. All the medium sized corms (16-25g) were treated separately with GA_3 and PP333 just 24 hours before planting. The plot size was1.05 m x1.00 m. The treated corms were planted in November 15, 2007 at a depth of 6 cm furrows maintained 25 cm row to row and 15 cm plant to plant distance. The irrigation, fertilizers and manures were applied as recommended by Anon.(1996) for gladiolus. Plant protection measures and interventions were applied for good growth of the crop when necessary. Data were recorded from randomly selected five plants except 80% emergence, 80% spike harvest and yield per plot. The self-life of the flower was assessed in the laboratory keeping flowers in the vases at room temperature. The experimental data were analyzed on MSTAT package programme and the means were compared by Least Significant Difference (LSD) following Gomez and Gomez (1984).

Results and Discussion

Effect of various growth regulators with different dosages are presented and discussed below:

Days to 80% emergence

Growth regulators showed significant effects on the days required to 80% emergence of the corms (Table 1). It was found that GA_3 treated corms @ 200 ppm required minimum time for 80% emergence (9 days) followed by GA_3 @100 ppm (10 days) whereas PP333 showed 14 days in all concentrations. Mohanty *et al.* (1994) also observed that paclobutrazol at any dose had no effect on germination of corms. However, this may be due to freshly harvested corms and cormels undergo a period of dormancy, which has regulated by changes in the levels of endogenous promotery or inhibitory substances and require longer time. Abscisic acid was found to be the major endogenous inhibitor controlling the sprouting of corms and treatment with certain growth regulatory substances such as ethrel or GA_3 is known to promote corm sprouting (Mukhopadhyay and Banker, 1986; Misra and Singh, 1989).

Number of tillers per hill

Various growth regulators had the significant effect on number of tiller per hill. GA_3 in all concentrations performed better (3.29-3.59) whereas PP333 had negative effect in increasing number of tiller even compare to untreated control (Table 1). It is reported that the PP333 is responsible for dwarf ness of plants have been tested on millets (Devlin, 1975), which showed anti growth regulator properties for glandulous.

Days required to first spike initiation

Days required to first spike initiation was significantly influenced by the application of growth regulators. Plants from corms treated with 200 ppm GA_3 initiated inflorescence earlier (64 days) followed by 100 ppm GA_3 (66 days) whereas it was 70 days in control. Emergence of' inflorescence started in plants from corms treated with 200 ppm GA_3 was 7 days earlier than that of control plants (Table 1). PP333 @ 80 ppm took the longest time (80 days) even than control. Prakash *et al.* (1998) reported that GA_3 treatment at higher concentration (150 ppm) improved all the floral characters including appearance of the flower spike in gladiolus.

Days to 80% spike initiation

Various growth regulators significantly influence the time required to complete 80% spike initiation of the plants. Corms treated with GA_3 (200 and 100 ppm) required 71 days and 73 days, respectively to 80 % spike initiation. On the other hand, treated with PP333 (@ 20 and 40 ppm, respectively) took longer time than control. It is evident that spike initiation enhanced with GA_3 treatments but PP333 delayed spike initiation in gladiolus.

Total number of spike initiation per hill

Growth regulators significantly influenced total spike initiation per hill in gladiolus. The results showed that total spike initiation was increased with the increase of GA_3 concentration. But reverse in case of paclobutrazol where it was decreased with the increase of concentration. Application of GA_3 @ 200 ppm resulted higher spikes (87.4- 91.4) while PP333 @ 80 ppm showed minimum spike (41.2%) which was even much lower than the control (Table 1).

Table 1. Effect of growth regulators on plant emergence, tiller per hill and spike initiation in gladiolus during 2006-07

Treatment		Days to 80% emergence	Number of Tillers/hill	Days to first spike initiation	Days of 80% spike initiation	Total spike initiation per hill
Control	-	13	3.0	70	79	84.7
GA_3	50 ppm	11	3.3	68	76	87.3
	100 ppm	10	3.4	66	73	89.4
	200 ppm	9	3.6	64	71	91.4
PP333	20 ppm	14	2.7	75	84	70.2
	40 ppm	14.	2.5	76	87	69.4
	80 ppm	14	2.3	80	----	41.2
LSD (0.05)	-	0.7	0.21	3.4	3.9	4.6

Days to 80% harvest of spike

Days required to 80% harvest of spike varied significantly among the treatments. Corm treated with GA_3 (100-200 ppm) took shorter days (82- 87) compared to control (90 days). The longer days (97 -100 days) was required in PP333 treated plots even than control (90 days). The result suggested that the higher concentration of GA_3 led to earlier harvesting (Table 2). On the other hand higher concentration of PP333 delayed harvesting time. This was probable that color break occurred quickly in higher concentration of GA_3 which was reversed in case of PP333. The results are in agreement with the results of Mohanty *et al.* (1994) who reported the earlier color break in the basal florets occurred when GA_3 was used @ 250 ppm.

Table 2. Effect of growth regulators on growth and flower production of gladiolus

Treatment		Days required to 80% harvest	Spike length (cm)	Rachis length (cm)	No. of florets per spike	Shelf life (days)
Control		90	58.7	46.8	12.9	10
GA_3	50 ppm	87	60.6	48.0	13.4	12
	100 ppm	83	62.1	49.2	13.6	12
	200 ppm	82	63.9	50.6	14.0	13
PP333	20 ppm	97	46.5	37.4	11.2	10
	40 ppm	100	45.4	36.0	10.4	10
	80 ppm	----	40.5	34.4	9.9	8
LSD (0.05)		2.08	1.77	1.55	0.46	0.73

Length of spike

Growth regulators had significant effects on the length of spike in gladiolus. The highest spike length (63.9 cm) was obtained from the plants treated with GA_3 200 ppm which was singnificantly different from other treatments whereas it was much lower (40.5- 46.5 cm) in the treatment of PP333 at all concentration even compared to control (58.7 cm) treatment (Table 2). The results are similar to the findings of Sindhu and Verma (1997) who reported that the spike length was increased with 250 ppm GA_3. From the results it is revealed that PP333 act as growth retardant.

Length of rachis

Different growth regulators had significant effect on the rachis length of gladiolus. The maximum rachis length (50.6cm) was measured from the corms treated with GA_3 @ 200 ppm followed by100 ppm GA_3 (49.2cm). Bhattachwjee (1984) also reported increased rachis length when the corms were treated with GA_3. On the other hand, PP333 resulted in shorter rachis length (34.4-37.4cm) even compared to control (46.8). Ginzburg (1974) reported that GA_3 stimulated the assimilate movement towards the inflorescence at the expense of corms which resulted in the better quality of spike.The shorter rachis from the corms treated with PP333 suggests its growth retardant characteristics.

Number of florets per spike

Different growth regulators showed significant effect on the number of florets per spike in gladiolus. Maximum number of florets per spike (14.00) was obtained from corms treated with 200 ppm GA_3 followed by100 ppm (13.6).The minimum number of florets per spike (9.9) was produced by corms treated with 80 ppm PP 333 where control plots showed 12.93 florets per spike (Table 2). Results are the agreement with the findings of Mohanty *et al.* (1994) and Prakash *et al.* (1998) they concluded that GA_3 increased the number of florets per spike in gladiolus.

Shelf-life of spike

There are significant variations were found among different growth regulators in respect of shelf life of spike in gladiolus. Spikes obtained with different concentrations of GA_3 showed 12-13 day whereas 8 days required with 80 ppm PP333 in comparison with control 10 days (Table 2). It is revealed that GA_3 increase shelf-life with the increase of concentration. But in case of PP333, shelf-life decreased with the increase of concentration. Over all GA_3 @ 200 ppm showed better result in yield attributes and shelf life of flower production of gladiolus.

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